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ABSTRACT

This paper presents a schema developed to investigated story recall in elementary school children, and describes the results of a study which tested the schema with first and fifth graders. The story schema, a theoretical model which formally defines the types of strategies, operations, and structures inherent in the processor of story information, is defined and its assumptions and rules are discussed in detail. The study of 48 first and fifth graders examined: (1) the effect of age and time on the production of stories; and (2) the usefulness of making distinctions between different types of story information. Each of the children listened while the experimenter read two of the four stories selected for the study. The children were then asked to recall the stories after 20 seconds of counting exercises, and again after one week. Although there were significant differences in total accurate recall due to age and time conditions, the organization of recall in terms of saliency of informational units was found to be extremely stable. The types of frequency of category information recalled were consistent across stories, grade level, and within time conditions, which suggests that certain types of information are more important than others in producing stories and that story recall is somewhat independent of simple primacy and recency effects. (Author/ED)

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An Analysis of Story Comprehension in Elementary School Children: A Test of a Schema

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An Analysis of Story Comprehension in Elementary School Children: A Test of a Schema

In the past few years, the number of investigators studying the comprehension of narrative material has risen sharply. Before the recurrence of this interest, very few investigators had made an attempt to understand the dynamics of this complex process. Bartlett (1932) was one of the few people who began, in earnest, an investigation of narrative comprehension in adults.

In his pioneering work, Bartlett (1932) examined memory for narratives and argued that narrative recall is highly organized and that subjects do not remember the exact syntactic and semantic structure of material. The information undergoes blending, omissions, inventions and similar transformations. Bartlett felt that in most instances subjects tended to get an impression of the whole story and, on the basis of this information, reconstruct the details that could have occurred in story material. He emphasized the point that the semantic representation of narrative material must be regarded as the product of the interaction between the incoming information and the strategies, mental operations, and structures inherent in the subject.

Many studies have shown the validity of Bartlett's assumptions concerning the processing of sentence and prose information (see Bransford and McCarrell, 1974; Paris, 1975; for recent reviews of this research). However, what is needed to gain a deeper understanding of this complex process is some type of theoretical structure or model which formally defines the types of strategies, operations, and structures inherent in the processor. Recently, Rumelhart (1975) and Shank (1975) have constructed models which attempt a definition of some of these variables.

Two of the basic requirements for any type of model or structure of prose comprehension is that it contain rules for defining the types of informational

units contained in the material and that it define the types of relations that exist between these units (Bever, 1972). These rules would permit a precise definition of the information contained in a passage and would enable an investigator to make specific predictions concerning the way in which this information would be encoded and internally represented by a subject.

The first step involved in developing a model, therefore, involves a choice of the unit of analysis. A unit is a measure of information and is a relative concept. The choice of unit will depend upon the questions asked by an investigator. When an investigator chooses a unit of analysis, several assumptions are generally made concerning this choice:

1) The unit is assumed to correspond to the types of categories processors use in structuring and remembering information on a psychological level. This assumption is interpreted to mean that units are manipulated, stored, and retrieved as single chunks of information.
2) The unit can often be described in terms of lower level units and the relations between these units.
3) The unit can be joined to other units of the same level by specified relations in order to form higher order units.

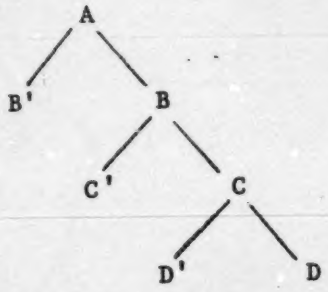
It has been generally assumed that the unit chosen for marrative analysis must be larger than the individual word. The unit most widely used to date has been the proposition (Fillmore, 1968; Kintsch, 1974). A proposition is defined by a relational word (the most common type of relational word is the verb) and one or more arguments which stand in some specifiable relation to the relational word, e.g., the actor of a verb, or the animate being which carries out the action referred to by the verb. A proposition roughly corresponds to a simple sentence.

The use of the proposition or a similar linguistic unit alone is not adequate for a complete description of a prose passage. An analysis of a passage into propositions does not provide information concerning the relative importance of individual propositions within the passage, nor does it indicate how these units are logically related to each other. A model of processing requires an analysis of the types of information which can occur in prose and of the types of relations which can exist between units. In order to do this, it is necessary to specify the kind of prose which is being examined. It can be assumed that different types of prose contain different types of information and different inter-unit relations. The present study is concerned with the comprehension of one type of prose: the story or folktale.

Recently, Rumelhart (1975) developed a schema or grammar which attempts to represent a processor's internal organization of story material. He began the construction of this grammar for stories by analyzing the structure of folktales, fables, and myths. This type of narrative has two major characteristics: it is usually orally transmitted and its frequency of transmission is extremely high (see Lord, 1965; Colby and Cole, 1973; and Propp, 1958; for studies of folktales). Even though there is variation in the production of a tale as it is retold, the end result is that a stable organization emerges; that is, the type of logical sequence produced upon recall remains highly consistent despite variations in the specific content added to or deleted from the story.

In his schema for stories, Rumelhart's primary unit of analysis is defined as an informational node or category. This unit is defined by the type of information contained in a story and by its function in the story. Several such categories are defined in his model. These categories can be described in terms of a hierarchical network in which a logical sequence is created among the categories and specific relations determine the degree of causality existing between any

two categories. In describing the hierarchical network, Rumelhart makes two assumptions about its structure: 1) each of the primary nodes can be described in terms of higher order categories and 2) the hierarchy is basically a binary network. Thus, the internal representation of a story can be portrayed in schematic form as:



The highest order category in this network is A. A can be defined in terms of B' and B. B' is a primary category and cannot be further divided into other primary categories. It can contain multiple elements but all of the elements have an underlying similar feature which makes them belong to category B'. Conversely, category B is a higher order category which can be defined in terms of C', a primary category and C, another higher order category.

Rumelhart's assumptions underlying this hierarchical organization are different from Shank's (1975) assumptions. In the construction of his model of narrative comprehension, Shank argues that for many kinds of information there is no need for superordinate categories, such as A, B, and C. The categories can be linked together directly by a single causal chain. Thus, A could be represented as:

B'
|
C'
|
D'
|
D

where D is the last remaining category in the sequence and is therefore defined as a primary category.

To date, there is no empirical evidence supporting the validity of either of these internal representations. In our schema, which is an adaption of Rumelhart's basic grammar, we have retained the concept of the higher order node or category. This was done because this type of description provides an excellent method for describing the hypothesized internal representation of many stories. However, we would hope that as more data are collected on story comprehension, both of these organizations can be incorporated into a more complex model. It is entirely possible that a processor may have both types of representations available and use one or the other depending upon the task requirements given. Furthermore, by using Rumelhart's basic grammar, we do not imply that all stories can be represented as a simple mechanical unfolding of informational nodes or categories. We present numerous ways in which the structural variation and complexity of stories can be represented by our schema. Some of these will be discussed in the presentation of our grammar.

In an initial study which we completed (Stein and Glenn, 1975), Rumelhart's schema for stories (1975) was used to analyze story recall protocols from elementary school children. Several difficulties were encountered in an attempt to apply his original story grammar to the analysis of recall. The grammar did not contain enough categories or nodes for analyzing many stories and folktales found in children's literature. Also we found that the hierarchical network of categories described in Rumelhart's grammar is not always binary in nature. There are specific instances where a higher order node can be defined in terms of two primary nodes and a higher order category. This occurrence is described in more detail in our story schema.

The next section includes the presentation of the schema which we used in analyzing the four stories presented in this study. In addition, over 50 other children's stories and fables were used to aid in the construction of this schema. We then present several predictions concerning the development of story recall in elementary school children. These predictions were derived from our initial study, thus we were concerned with the generalizability of our original data base. The third section presents data from an initial study conducted to test this schema. This study presents an analysis of story recall in first and fifth grade children.

The Story Schema

The schema make several assumptions concerning the analysis of stories. The first assumption is that story material has some type of internal representation much like sentences and words (Rumelhart, 1975). The second assumption is that this internal representation can be described in terms of a network of categories and the logical relations which exist between these categories. The categories are types of information which reoccur in most folktales or fables. The structural network of categories is assumed to be hierarchical. The hierarchical organization of the schema indicates that there is a logical order to the occurrence of each postulated category, and the relations between the categories specify the degree to which a preceding category influences the occurrence of the subsequent categories. The first section of the schema presents the rules which define the types of primary and higher order categories and the relations between any two categories in a simple story. Figure 1 lists all of the rules to be discussed in this section. Figure 2 presents the hierarchical structure

of a simple story. It should be noted that most story representations are more complex than the simple story. The structural variations and complexities which can occur are presented at the end of this section.

A story consists of a setting category plus an episode system. These two categories are connected by an ALLOW relation. The rule structure for defining these categories is given by:

Rule 1: Story → ALLOW (Setting, Episode System)

The setting category serves two functions in the story. It introduces the main character(s) and it describes the social, physical or temporal context in which the remainder of the story occurs. The type of information contained in this category is basically stative in nature and refers to long term or habitual states of characters or locations. However, an activity of a character may also be included in the setting if it describes habitual behavior patterns. The types of information in a setting statement are defined by:

Rule 2: Setting → { State(s) / Activity(s) }

Several states or activities can occur within the setting category, and each of these is considered to be an exemplar of the setting category. Each exemplar of a specific category is defined as a base level statement. When more than one state or activity occurs in a category, each is related to the other by one of three types of relations: AND, THEN, and CAUSE. The AND relation describes the case in which two units co-occur in time and are not temporally connected. The THEN relation refers to the case in which one statement temporally precedes a second statement but does not directly cause the second; though it may create the necessary preconditions for the second statement to occur. The CAUSE relation refers to the situation in which one statement directly influences the occurrence of the second statement.

The AND relation is the most common type of relation between setting state-

ments. For example the setting category of a story could be composed of the following four base level statements:

1. Once there was an old lady
2. who lived in a small village.
3. She ran the local bakery
4. and made the best pies in the village.

The first statement introduces the main character and the second statement describes the physical surroundings of the character. The third and fourth statements describe habitual, ongoing activities of the character. All four base level units are connected by the AND relation.

Although both the character introduction and the descriptions of the story context are considered to be setting statements, the two types of information sometimes assume different functions in describing the story schema. It is almost impossible to begin the production of a story without including a character introduction. In stories where there is no specific character introduction, almost all children construct their own introduction in order to begin story recall (Stein and Glenn, 1975). This type of statement appears to act as a marker for the intiation of the schema. The other type of statements may or may not assume a similar importance in the production output of the story. Therefore, we have labeled the character introduction as the Major Setting category and the remainder of informational statements as the Minor Setting category.

Setting statements generally occur at the beginning of a story, but they can occur almost anywhere in the sequence of the story schema when it is necessary to describe a new character or new physical and social contexts.

The setting category is connected to the remainder of the story, the Episode System, by an ALLOW relation. The ALLOW relation is a weak causal link implying

that the setting creates the necessary conditions for the story to occur, but does not directly cause the subsequent behavioral sequences. The degree of relationship between the setting category and the remainder of the story varies depending upon the individual narrative. Some stories simply introduce the character, give a few descriptive statement and then proceed to the episode system. In these stories the setting does not tell you anything about the character's past or present behavior and does not give any clue or advanced information about the events to occur in the remainder of the story. However, in many children's stories, especially those adapted for young readers, the setting often is more directly related to the subsequent occurrences in the remainder of the story. For example, many settings relate the type of internal desire the character has expressed over a long period of time. The remainder of the story often details just how this internal state changed or influenced a character's subsequent behavior. The ALLOW relation is defined to include these varying degrees of causality.

The remainder of the story structure is described by an episode system. An episode system, like a story, is a higher order category and incorporates the entire story structure with the exception of the setting. An episode system consists of one or more episodes and is defined by the rule:

$$\text{Rule 3: Episode System} \longrightarrow \begin{matrix}\text{AND} \\ \text{THEN} \\ \text{CLAUSE}\end{matrix} \quad (\text{Episode}, \text{Episode})$$

Most stories contain two or more episodes which can be related to each other in several ways. Because of the complex inter-relations which can exist among episodes, the schema of a simple episode will be described first.

An episode is the primary higher order unit of a story and consists of an entire behavioral sequence. It includes the external and/or internal events

which influence a character, the character's internal response (goals, cognitions, plans) to these events, the character's external response to his goals, and the consequence resulting from his overt responses. Inherent in this sequence is a causal chain of events beginning with an initiating event and ending with a resolution. Thus, an episode structure is defined as:

Rule 4: Episode ⟶ INITIATE (Initiating Event, Response)

which states that an episode consists of an initiating event plus a response. These two categories are connected by the INITIATE relation. The main function of an initiating event is that it causes a response in the main character. The INITIATE relation denotes a causal connection between the intiating event and response. Three types of statements are classified as initiating events:

Rule 5: Initiating Event ⟶ Natural Occurrence(s)
Action(s)
Internal Event(s)

Natural occurrences are changes of states in the environment and are not caused by an animate being. Examples of these types of occurrences would be, "the chimney began to crack and fell on the roof." An action performed by either the major character or a minor character is also considered to be an initiating event if it evokes a response in a character. In one of our stories, Epaminondas, a boy's mother tells him to take a cake to his grandmother's house. The mother's action, in this story, is considered to be an initiating event. An action originating in the main character can also be classified as an initiating event. For example, the little boy, Epaminondas, could have baked the cake. If he reacted to his own baking by deciding to share it, show it to his grandmother, etc., then his initial action is classified as an initiating event.

Internal events such as the perception of an external event are also classified as an initiating event. For example, the beginning of an episode might be "One day, the little boy heard strange footsteps outside the door." If the

boy reacts to his perception by formulating a response, then this type of statement can be classified as an initiating event. Changes in internal physiological states, such as hunger, pain or sickness are also considered to be internal initiating events.

Setting and event statements can generally be distinguished because the former refer to habitual states or actions while the latter refer to changes in such states or to novel actions. Their major difference, however, is that they have different functions in the story. The setting provides the context for the story while the event is an immediate cause for a response on the character's part.

The initiating event category can include several statements in sequence. These statements are related by the same three relations which connect individual statements in the setting category: AND, THEN and CAUSE.

The next higher order category, the response, consists of an internal response plus a plan sequence and is defined by:

Rule 6: Response $\longrightarrow$ MOTIVATES (Internal Response, Plan Sequence)

The internal response refers to the psychological state of a character after an event. Its main function is to MOTIVATE the character to formulate a plan sequence. The internal response category is defined in Rule 7 and contains three types of statements: affective responses, goals, and cognitions.

Rule 7: Internal Response $\longrightarrow$ $\left\{\begin{array}{l}\text{Affective Response(s)}\\ \text{Goal(s)}\\ \text{Cognition(s)}\end{array}\right\}$

Affective responses include all types of emotional responses, such as happiness, sadness, despair, and indicate that a state of disequilibrium has occurred in a character. Goal statements refer to the desires or intentions of a character. Cognitions are statements which refer to a character's thoughts. Most cognitions begin with phrases like -- she knew, she remembered, she realized,

she thought, etc.

The internal response can contain one, two or all three of these types of statements. There is no fixed order among these three types of statements, although certain patterns are quite common. In many stories, an emotional response occurs in reaction to an initiating event. The emotional response causes a state of disequilibrium and the character responds by formulating a goal to restore an equilibrium. The following statements illustrate this phenomenon:

1. One day, Jack took all of his grandmother's cookies. (Event)
2. His grandmother became very angry (Affect, Internal Response)
3. and decided to teach Jack a lesson. (Goal, Internal Response)

The grandmother responds to Jack's activity by becoming angry (affective response) and then formulates a goal to restore a state of equilibrium. Cognitions can occur before or after each of these statements.

In many stories there is a direct causal connection between two statements in the internal response category. However, as the internal response category increases in the number and complexity of statements, the types of connectors increase. Therefore, the three types of logical relations which can exist between any two statements in this category are: AND, THEN, and CAUSE.

Many written stories do not contain the internal response category in the episodic structure. The omission of this category can indicate that a character's feelings, goals and thoughts are implicit either from the type of initiating event which has occurred or from the behavior which follows the internal response. However, even when the written story does not contain a character's internal response, the schema for understanding and producing the story structure does.

The next higher order category, the plan sequence, can be divided into the internal plan plus a plan application:

Rule 8: Plan Sequence $\longrightarrow$ MOTIVATE (Internal Plan, Plan Application)

The MOTIVATE relation again connects the internal plan to the plan application and implies a direct causal link between the two. The internal plan consists of a series of statements which define a character's strategy for obtaining a change in the situation. The function of an internal plan is to direct the character's subsequent behavior. It is composed of two types of information: subgoals developed in order to achieve the main goal, and cognitions about the situation, the hypothesized activity or the consequences of the behavior. It is defined by the rule:

Rule 9: Internal Plan ⟶ (Cognition, Subgoal)

An example of an internal plan can be seen in Story 2, The Tiger's Whisker. The internal plan category is omitted from most children's stories because most characters have one major goal and use only one or two actions to obtain their goal. The internal plan usually occurs in stories where the character perceives some difficulty in goal attainment and must think of a sequence of subgoals which are necessary if the major goal is to be obtained. If several statements occur in the internal plan, the three relations - AND, THEN and CAUSE - can connect any two statements. The internal plan of the character MOTIVATES the plan application.

The plan application refers to both a character's overt attempt to attain his goal and the resolution of his conflict or disequilibrium that was caused by the initiating event:

Rule 10: Plan Application ⟶ $\overset{\text{RESULT}}{\underset{\text{THEN}}{\ddots}}$ (Attempt, Resolution)

The attempt and resolution categories are connected either by a THEN relation or a RESULT relation. The RESULT relation signifies that the attempt directly causes the resolution. In many stories, however, the attempt is not a direct cause of the resolution but instead creates the necessary preconditions for the occurrence of this category.

The attempt category is composed of a character's overt behavior or actions and is defined by the following rule:

Rule 11: Attempt ⟶ (Action(s))

As is true of the other primary categories, the attempt can contain several actions in sequence. These units can be connected by any of the three type of relations: AND, THEN and CAUSE.

The final higher order category is the resolution which consists of a direct consequence and a reaction:

Rule 12: Resolution ⟶ INITIATE (Direct Consequence, Reaction)

The direct consequence INITIATES the reaction and implies a direct causal link between the two categories.

The direct consequence category marks the attainment or non-attainment of the character's goal. Two types of statements can occur in this category: an event and an end-state. An event refers to any natural occurrence or action on the part of a subsidiary character. Most events are not foreseen by the main character but influence his goal attainment. Several events can occur in the consequence category. However, the last statement occurring in this category must be an end-state which marks the actual attainment or non-attainment of the character's goal. An example of both of these types of statements occur in the Fox and Bear story. In one of the episodes, there are three statements occurring in the direct consequence category:

1. The roof and the bear fell in
2. killing five of the chickens
3. The fox and the bear were trapped in the broken henhouse.

The first two statements are event statements with event 1 causing event 2 to occur. Event 1 also causes the third statement, the end-state, to occur.

Statement 2 and statement 3 occur simultaneously and are connected by the AND relation. Rule 13 states the definition of a direct consequence:

Rule 13: Direct Consequence ⟶ (Event(s), End state(s))

The occurrence of more than one end-state implies that the main character had more than one goal motivating his behavior. All three relations: AND, THEN and CAUSE can connect statements in this category.

The reaction is the final base level category which occurs in the structure of an episode. The types of statements which appear in this category are affective responses, cognitions, and actions:

Rule 14: Reaction ⟶ (Affect, Cognition, Action)

The reaction is similar in nature to a consequence but has broader implications than the consequence. This category includes statements defining how a character felt about the attainment of his goal or what he thought about it. A reaction can also specify how the attainment of an end-state affects a new character in the story. An excellent example of this occurrence can be seen in two of our stories: Epaminondas and The Tiger's Whisker. In Epaminondas, the boy arrives at his grandmother's with a crumbled piece of cake. These statements are included in the consequence category. The grandmother reacts to the crumbled piece of cake by telling the boy he's silly and then telling him how he should have carried the cake. The grandmother's response is defined as a reaction on her part. Her response contains an implied affective reaction and an overt action. The story does specify exactly what her affective response was. However, in defining the story schema, it is hypothesized that an affective response is an inherent part of a reaction.

The reaction category is similar in structure to the internal response category. However, there is one major difference. The reaction category contains no clear goal statement and does not lead to a plan sequence. In Epaminondas,

the grandmother simply reacts to the boy bringing the crumbled cake. If a goal statement had been included in her response to the boy bringing the crumbled cake, then it would be considered to be the start of a new episode. Thus, the reaction contains some type of emotional response to a consequence. In addition, it can include cognitions or actions which result from this emotional response. The AND, THEN and CAUSE relations are again used to connect individual statements in this category.

The reaction category usually occurs at the end of an episode, but it can also occur at other points in the episode. A character may have a reaction while he is involved in overt behavior. In some stories, characters pause to reconsider their goal but then proceed to complete their original plan sequence. If the consideration of a new goal does not cause a character to formulate a plan sequence, then the character's response is considered to be a reaction and not a complete internal response.

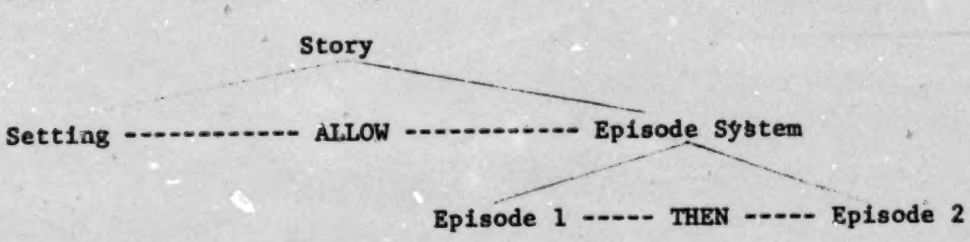
It is obvious from examining most folktales or fables that very few are as simply defined as the structure given in a simple episode. Many of Aesop's fables contain only one episode. However, most folktales contain two or more separate episodes, and many of these narratives contain what we have labeled as an embedded episode. The next section will consider the relations between episodes and various complexities which occur in the single episode.

Episodic Relations

Rule 2, which was presented earlier defined the structure and relations which comprise an episode system:

Rule 2: Episode System $\longrightarrow$ AND / THEN / CAUSE (Episode, Episode)

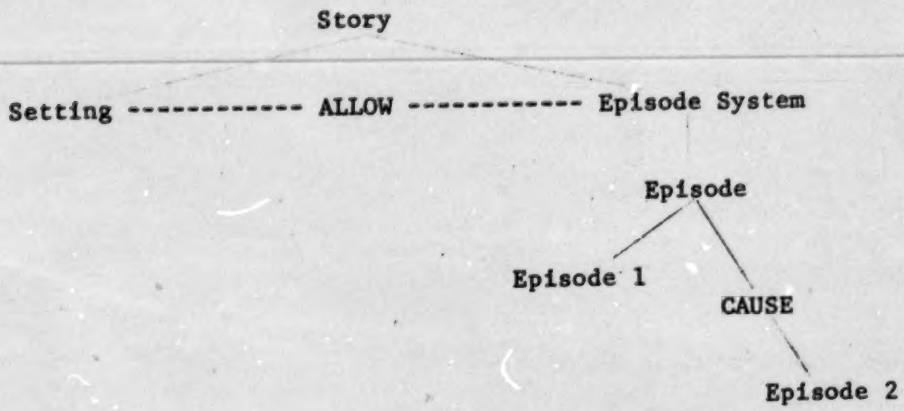
The rule states that an episode system consists of one or more episodes. Any two episodes can be connected by the three relations AND, THEN and CAUSE. The most common relations which connect episodes are the THEN and CAUSE relation. The THEN relation defines two episodes which occur in a temporal sequence where the first does not directly cause the second to occur but sets up the necessary preconditions for the second episode. A good example of this type of relation can be seen in the classic folktale, "Goldilocks and the Three Bears." When Goldilocks enters the Three Bears' home, two episodes occur in succession. The first episode recounts Goldilocks' discovery of the porridge, her desire to eat it, and the act of finishing the Baby Bear's porridge. The second episode describes her becoming fatigued, the discovery of the chairs and her plan sequence of finding a suitable chair to sit in so that she might rest. The first episode does not directly cause her behavior in the second episode, but it may set the necessary conditions for its occurrence. The diagram below illustrates an episode system which contains two episodes connected by the THEN relation:



The horizontal relationship between two episodes connected by the THEN relation indicates the lack of direct causality.

The second type of relation which connects two episodes is the CAUSE relation. The CAUSE relation implies a direct causal connection between two episodes. An

example of this type of inter-episodic relation occurs in the Fox and Bear. The resolution of one episode occurs when the roof falls in and traps the fox and bear inside the henhouse. The next episode contains the behavioral sequence of the farmer who comes out to see what was the matter. Implied in this episode is that fact that the farmer must have heard some type of noise which then causes his investigation. This type of relation between episodes can be diagramed as follows:



The diagram reads: a story consists of a setting plus an episode system. The episode structure contains an episode which includes both episode 1 and episode 2. The causal relation between episodes 1 and 2 is indicated by the vertically descending structure in the diagram.

Certain problems arise when the CAUSE relation is used to connect episodes. In many stories the one episode does directly influence the behavioral sequence in the second. However, in many stories the processor must infer that there is a direct causal link between the two. Children below a certain age may not have the ability to make the types of inferences necessary to perceive the direct relationship between two behavioral sequences. Thus, their internal representation may be quite different from that of an older child's or an adult's organization of the material. The Epaminondas story used in this study may,

in fact, illustrate this point. Older children may immediately grasp the relationship between the grandmother's telling the boy how he should have carried the cake and the boy's subsequent action of carrying butter in the way his grandmother told him to carry the cake. However, young children may not grasp the connection between the two. In the latter case, the two episodes in this story would not be causally related. They would be connected by a THEN relationship.

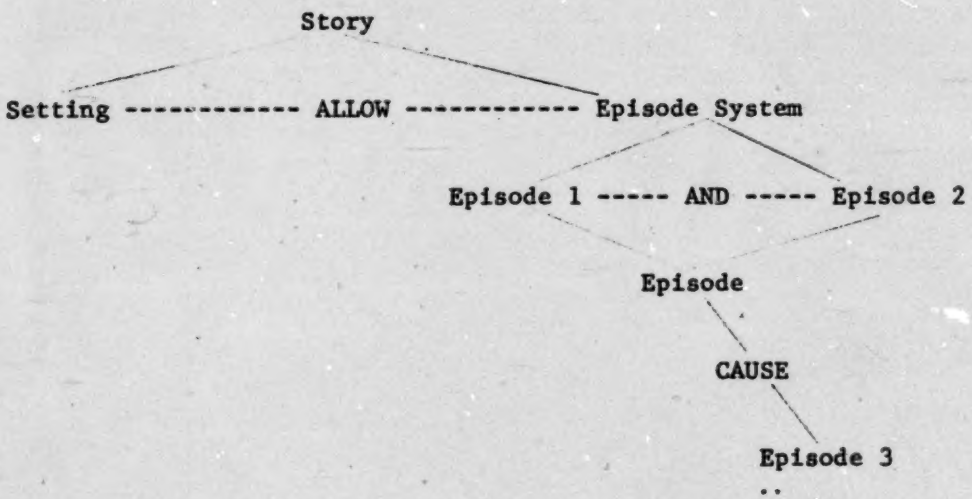
The reverse phenomenon may be true when considering the representation for episodes connected by the THEN relation. The original story version may have no direct causal relationship between two episodes. However, a subject, especially an older child or adult may perceive a direct causal relation between the two episodes by use of inferential thinking. Thus, in many instances, it is extremely difficult to represent the correct relation connecting episodes.

Similar problems occur when the internal representation for a single episode is constructed. Although almost all inter-category relations are directly causal in nature, this is not true for intra-category relations. Intra-category statements can be connected by AND, THEN, or CAUSE. There are many times when the original external version of a story contains two statements which are connected by the word then. In constructing the relation between these two statements in the internal representation, there is often a direct causal link perceived between the two statements. This link is then represented by the CAUSE relation. Thus, the internal relations which connect both intra-category statements and two episodes in sequence may vary depending upon the age of the subject and the type of inferential reasoning that occurs during stimulus presentation.

The third type of relation that can exist between two episodes is an AND relationship. This relationship describes two episodes which occur simultaneously.

Although none of our stories has two episodes occurring simultaneously, we have found a few folktales which do contain this type of episodic relation. The episodes occur in a temporal order in the story presentation but the type of connector which links the two episodes denotes simultaneity, i.e. meanwhile, at the same time, while the fox was doing this, etc. After two simultaneous episodes occur, both are usually related to a third episode by a THEN or CAUSE relationship.

The number of relations which can exist between the two simultaneous episodes and a third episode varies. However, diagram 3 illustrates the most common relationship between simultaneous episodes, and the type of structural organization between two simultaneous episodes and a third episode:



This diagram shows that the episode system is composed of three episodes. The first two are connected by the AND relation. They can be combined to form an episode which then causes the third episode to occur.

A fourth type of episodic relation occurs in many stories. This occurrence is defines as the embedded episode relation. An embedded episode is an episode which begins <u>after</u> a previous episode has begun and ends either before or at the same time as the previous episode. This type of episode occurs frequently when the main character's attainment of a goal is dependent upon the behavioral

actions of a second character. An example of this can be seen in our Judy story, which contains two embedded episodes in a third episode. The main character wants something and depends upon another character for the goal fulfillment. When this occurs, an embedded episode structure is necessary because the behavioral act of the second character fulfills the requirements for the creation of an episode. In the Judy story, Judy wants a hammer and a saw and asks her father to get them for her. The act of Judy asking for these things is the event, from the father's perspective, which begins the embedded episode; it remains, however, an action from Judy's perspective. This illustrates how one statement can serve two functions within a story. A second example of this type of episode can be seen in the Tiger's Whisker, the second story used in the present experiment. The lady develops a plan or trick for obtaining a tiger's whisker. She begins her plan application by giving the tiger food and singing to him. The attainment of her goal, however, is contingent upon the tiger's behavioral sequence which is an episode embedded in the episode constructed to represent the lady's behavioral sequence.

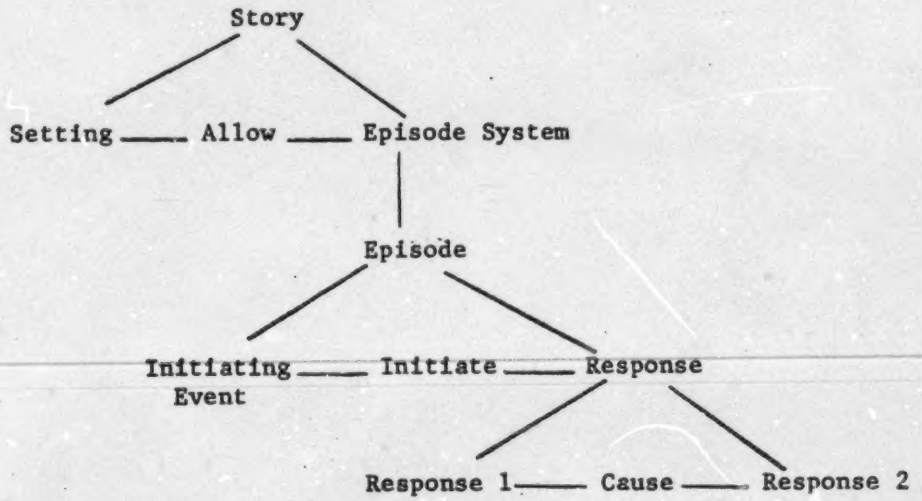
An embedded episode can also occur when only one character is involved in a story. A character may react to an initiating event by formulating a goal and begin an action to achieve the goal. However, after having carried out an action, a reaction may take place which initiates the formulation of a second goal. The pursual of this goal may displace the pursual of the other for a while. An example of this type of episode can be seen in the fable of a Dog's Reflection. In this fable a dog has stolen a piece of meat. He wants to get it to a safe place to eat it undisturbed. He starts to cross a bridge but, as he does, he looks down into the water. He sees the reflection of a dog with a piece of meat in its mouth. He decides that he wants the piece of meat in the second dog's mouth, grabs for it and loses his own meat. In this story, the embedded episode starts with the dog looking into the water. This action

statement causes the dog to formulate an additional goal -- he wants a second piece of meat and thus carries out an attempt to obtain his second goal. In the act of doing this, both of his goals are blocked.

Variations, other than that of the embedded episode, occur within a single episode. The most common variation in single episode structures is the case in which the episode contains two responses or two plan sequences. Sometimes the main character fails to attain his primary goal on his first attempt. He often formulates a different plan of attach in his second attempt. His primary goal, however, remains identical to the goal expressed in the first response. Therefore, his second response is considered to be part of the same episode motivating his first response. In addition, the same initiating event that caused his first response also causes his second response to occur. The fourth story used in this experiment serves as an excellent example to illustrate the case in which two full responses occur within a single episode. In this story, Judy is going to have a birthday party. She decides that she wants a hammer and a saw. She proceeds to ask her father to get them for her but he does not fulfill her desire. She then tells her grandmother about her desire because she still wants to get the tools. Thus, the goal statement in Judy's second response is identical to that in the first response. There is no need for a new episode to describe her behavior in the second response.

Sometimes a character formulates more than one goal in response to an initiating event. In many instances, the types of goals formulated do not form a hierarchy with one goal being the major goal and the remainder being subgoals which are caused by the first. The goals are somewhat independent of one another, and the character proceeds to complete one plan sequence and then a second one. In this case, two plan sequences contained in a single episode would be constructed to represent the behavior of a character. The diagram below illustrates the organization of an episode when two responses occur in a single episode.

The structure is similar to that used to represent Judy's Birthday, the fourth story used in this experiment.



A second type of variation occurs in a single episodic structure when a setting or reaction occurs at various places within the episode. As stated before, setting statements can occur almost anywhere in the structure of an episode. They do not have to occur at the beginning of the story. When they appear within a single episode, the binary nature of the descending hierarchical structure is somewhat different.

An example of a setting statement occuring in the middle of an episode can be illustrated by an example from the story, The Tiger's Whisker, which was used in this study. A setting statement occurs immediately after an attempt statement:

1) She (the lady) went to a tiger's cave (Action, Attempt)

2) where a lonely tiger lived (State, Minor Setting)

The minor setting does not cause the attempt to occur but provides the necessary preconditions for its occurrence. The internal structure of this story variation is illustrated in the diagram below:

and indicates that the plan application consists of two primary categories plus a higher order category. In these cases, the descending hierarchy of the story structure is not binary.

The final comment on the story schema concerns the definition of an episode. In almost all folktales, some of the postulated categories in the internal representation of an episode are missing from the external version of the story material. For example, many folktales do not include the character's internal responses or a reaction at the end of an episode. Most tales do not include the internal plan. Some do not include an initiating event or an attempt. In order to be considered as an episode in our schema, a behavioral sequence must contain some reference to:

1) the purpose of the behavioral sequence

2) overt goal-directed behavior

3) the attainment or non-attainment of the character's goal

If these three criteria are not met, then the behavioral sequence is defined as an incomplete episode. An example of an incomplete episode occurs in one of our stories, The Fox and Bear. In the last episode the resolution is omitted. The episode does not specify what the farmer did after he came out to see what happened. Thus, his behavioral sequence is incomplete.

In attempting to construct his story schema, Rumelhart (1975) proposed a set of summarization rules which would predict the types of deletions, integrations, and transformations which occur in the production of story recall. We have not attempted to construct a set of formal rules for summarization in this initial paper. However, if the concept of a behavioral sequence as defined above is

valid, we would expect that the recall protocols would include information defining this sequence. While the recall protocols will not contain all of the information contained in the original, the basic logical structure will be retained; this includes statements refering to the major purpose of an episode, to the purposive behavior of a character, and to the attainment or non-attainment of the goal. Information which is not directly related to that sequence or which serves only to elaborate the sequence will be omitted.

A representation of each of the stories was constructed. If an informational category postulated by the model was not explicitly given in the original story, it was nonetheless included in the representation. These structures can be seen in Figures 3a, 4a, 5a and 6a. The original stories read to the subjects appear in Figures 3, 4, 5 and 6.

The next two sections present the findings from two initial studies designed to investigate the effects of age and time on story recall and to examine the validity of some of the assertions made in describing the story schema.

Experiment I

There is considerable evidence (Bartlett, 1932; Johnson, 1970) indicating that adults' recall of prose information is well organized; that is, (a) the information which is well recalled is not random; certain informational units are consistently better recalled than others, (b) there is a high degree of consistency in what is recalled across subjects, (c) there is a high degree of consistency in what an individual recalls over time, (d) the sequencing of the information is not random but seems to follow some logical order, and (e) the inferences which are included in recall are not random but are generally meaningful additions. These questions have not been systematically raised in the developmental literature. One of the reasons for this has been the lack of a clear method for defining and quantifying the information contained in prose

material. In the following study, the grammar was used as a methodological tool for examining the way children organize story information. In particular, the following questions were raised:

1. Are children's recall of stories highly organized? If this is the case, we would hypothesize that (a) both the informational units which are well recalled and the informational deletions will be highly consistent across subjects, at least at a given grade level; (b) the pattern of what is recalled will be highly consistent over one week's time; (c) the temporal sequencing of the information which is recalled will be quite stable.

2. Are there developmental changes in either the amount of information recalled or in the pattern of information recalled?

3. Do the informational categories postulated in the story theme correspond to distinctions which subjects make when processing information? If this is the case, we would hypothesize that the various categories would differ in their relative salience. Certain categories may be more significant than others and these should be consistently highlighted in recall over other categories.

Four stories were chosen for this study. They were all variations of current children's stories and were rewritten in order to be of approximately the same length. No attempt was made to make them correspond to the model either by including all the postulated categories in each episode or by equalizing the number of categories given. Nor was any attempt made to render the semantic or syntactic structures comparable across all stories. The tree structures for all four stories are presented in Figures 3a, b, c and d.

Method

Subjects

Subjects were 48 children from an upper middle class school in St. Louis County. An equal number of first and fifth grade children participated in the study. Approximately half of the children in each grade were males and half were females. The mean ages in each grade were 6 years, 5 months for first grade and 10 years, 6 months for fifth grade.

Materials

Four stories were used in the study. One story was a classical folktale, Epaminondas; this story has many different versions and one was selected for use in this study. The other three stories were constructed by reading a variety of folktales and then creating new versions of the tales. This procedure was followed because many of the initially selected stories were well known to the children participating in the study.

Design

The 48 subjects were divided by grade level into two equal groups. Each group was further divided into two groups of 12 subjects each. All children were tested individually. Within each group of 12 children, the same two stories were given in a counterbalanced order. Before the story delivery occurred, each child was told to listen carefully so that he could repeat the story exactly as he had heard it. The experimenter then proceeded to read the first story. After the story presentation, a 20 second delay occurred. During this time, each child counted backwards by three's from 50. Immediate recall was then collected. The experimenter presented the second story in an identical procedure. One week later, each subject was asked to recall both stories he had heard. The subject could recall them in any order. He received no cues from the experimenter.

The decision to tell children stories rather than present recorded versions was made on the basis of a pilot study. Young children experienced more difficulty in sustaining attention with recorded versions of the material. In order to control for experimenter bias in story delivery, two experimenters tested half of each group of 12 children at each grade level.

Procedure

At the beginning of each testing session, the subject was familiarized with the tape recording procedure. When the experimenter felt that the subject was relaxed, the session began. The experimenter told the child that he was going to hear a story. He was told to listen very carefully because when the experimenter finished the story, he would have to tell the story out loud exactly as he had heard it. The experimenter then read the first story to the child. Immediately after the story presentation, the child was asked to count backwards from 50 by three's. First graders simply counted to 20. Then the child was asked to recall the story exactly as he had heard it. After he finished, the second story was presented in an identical fashion. When the child finished, he was taken back to his room.

One week later, the child was tested again. He was asked to recall both stories he had heard in any order he could. This procedure was adopted so that the child would recieve no information concerning either story. Several first graders had difficulty beginning the stories but all of them managed to generate a coherent story for each of the two presentations.

Results

Accurate Recall

All of the statements in each of the four stories were parsed into the appropriate category specified by the grammar. The final parsings were completed by having three separate raters parse each individual story. When a disagreement

occurred among the three raters, the statement was assigned to the category which had been used by two of the three raters. The initial inter-rater reliability for the four stories was 92%. There were very few disagreements and raters disagreed on no more than three statements per story.

Each individual protocol was then scored for the total number of accurately recalled units. The criterion for inclusion in the accurate recall measure was based on the semantic content of a base level statement. For example, in the Epaminondas story, many children said, "the sun was real hot and melted the butter." Credit was given for both base statements, "the sun was shining hard," and "the butter had all melted." Again, each protocol was scored by two people. Inter-rater reliability on scoring items as correctly recalled was above 93% on all four stories.

Because there was no a priori reason to suspect story differences, each subject received a composite score, combining the total proportion of accurate recall on both stories. A three-way analysis of variance was then completed on this score with grade(1st, 5th) and story (stories 1 and 2; stories 3 and 4) as between subject factors. Time (immediate, delayed) was the within subject factor. All three main effects were significant. However, there was a significant two-way interaction and a significant three-way interaction. The interaction between time and story was significant, $F(1,44) = 9.46$, $p < .01$, but more importantly, the grade by time by story interaction was significant, $F(1,44) = 6.72$, $p < .02$, indicating that the stories were recalled differently in both grade and time conditions. Therefore, a separate two-way analysis of variance was completed on each of the four stories. In these analyses, grade was the between subject variable and time was the within subject variable. The mean proportion of accurate recall and significance levels for each story is presented in Table 1.

Insert Table 1 about here

There were no significant grade by time interactions in three of the four stories. In these three stories, grade was a significant variable, with 5th graders recalling a greater proportion of statements than 1st graders. Time was also a significant variable for two of the three stories; more statements were recalled immediately after presentation than one week later.

In the fourth story, Judy's Birthday, time was also a significant factor. However, a significant grade by time interaction occurred. Newman-Keuls tests were completed on the data. A significant grade effect was found on immediate recall with grade 5 producing more accurate recall on immediate recall than grade 1 ($p < .01$). There were no grade differences on delayed recall.

In summary, all four stories showed a significant grade effect on immediate recall and three of the four stories showed this effect on delayed recall. Time was a significant variable for three of the four stories, with a greater proportion of units recalled in the immediate condition than in the delayed condition.

The recall data from each subject was then grouped according to the seven categories specified in the grammar: major setting statements, minor setting statements, initiating events, internal responses, attempts, direct consequences, and reactions. Each subject received seven scores, each signifying the proportion of statements recalled in each of the seven categories. A separate analysis of variance was completed for each of the seven category scores with grade as the between subject variable and time as the within subject variable. All stories were analyzed separately. The results were quite variable. The only category which showed significant grade effects in all four stories was the internal response category. Fifth grade children recalled significantly more internal responses than first grade children. The mean proportion of internal response statements and the significance level for each category are presented in Table 2.

Insert Table 2 about here

The internal response category was also the only category which varied systematically over time. More internal responses were recalled at time 1 than at time 2 in three of the four stories. The mean proportion of internal response statements and their significance level for time 1 and time 2 are presented in Table 3. The significance of this finding must be evaluated in terms of an increase in internal response inferences; this will be discussed in another section.

Insert Table 3 about here

Saliency of Individual Categories in the Story Structure

The next group of analyses pertain to the establishment of validity for the seven types of categories which are described in the grammar. If the categories make distinctions which listeners make while hearing a story then certain categories may be more important than others and the extent to which each type of category is recalled should have a high degree of similarity over all stories and over both time conditions and both grade conditions. Therefore, several correlational analyses were completed to examine the strength of these relationships.

The frequency of recall of each individual statement in each story was determined and a rank order of items, proceeding from the best recalled item to the worst recalled item, was constructed for each grade level and each time condition. Spearman rank order correlations were then performed to assess the degree of relationship between grade levels and between time conditions. The results of this analysis are presented in Table 4. The correlations ranged from

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Insert Table 4 about here

.84 to .98 for grade comparisons and from .91 to .99 for time comparisons. Although there was some degree of variation over the four stories, each correl-

ation was highly significant, indicating that the extent to which an item is recalled is highly stable over time and between grade levels.

The frequencies of recall for individual statements were then clustered according to category membership. Then the proportion of statements recalled for each of the seven categories was determined for each of the four stories. Rank orders, consisting of the best recalled category to the worst recalled category, were constructed for each grade level and each time condition. The degree of similarity in the rank orderings across grades and across time conditions was extremely high. Kendall's coefficients of concordance were computed to assess the degree of relationship in the rank orders of the four stories for grade level and for time conditions. The grade coefficient was . , p .01, and the time coefficient was . , p .01. Both of these are highly significant.

Because grade level and time condition had such a small effect on the variation in the rank orders for each story, a rank order for each story was constructed by collapsing time and grade effects. Table 5 presents the results of the collapsed ranks.

Insert Table 5 about here

In all stories, the major setting category was the best remembered. Initiating events and direct consequences are the next best remembered categories. In all stories, these two categories are always second or third in the rank orders. The difference between the proportions of items recalled in these two categories was, for most stories, extremely small. The attempt category was fourth in all of the ranks except for one story, The Tiger's Whisker. In this story, the Attempt category was fifth. Internal Responses and Minor Setting categories were always recalled in the last three positions in the rank order.

The exact position of the Reaction category varied from fourth to seventh place. This category had a higher degree of variation than all other categories.

In order to more accurately assess the degree of recall variation in each category, the distribution of category variation was examined. All of the informational items were divided into thirds according to how well they were recalled, from the third best remembered items to the third least well remembered items. The proportion of each category recalled in each third was then determined and these proportions are presented in Table 6.

Insert Table 6 about here

Major setting statements and consequence statements were almost always found in the top third of the distribution. A few consequence statements were present in the second third of the distribution. The majority of initiating events are also in the top third of the distribution. There is a greater degree of variation in this category than in either the Major Setting or Consequence categories. This finding is also true for the Attempt category. The majority of Minor Setting statements and Reaction statements are found in the middle third of the distribution. The only category which is not well represented in the top two-thirds of the distribution is the Internal Response category. This category, however, contained 39 statements summed over the four stories and is the most diverse category in the grammar. It contains internal events, goals, affects, cognitions and plans. The types of internal responses which were represented in the top third of the distribution were the major goal of the main character. In the three stories which contained major goals, these statements were extremely well recalled and were always in the top third of the rank orderings. This finding suggests that major goal statements may be remembered differently from other types of statements in the Internal Response category.

Transformations Occurring in Individual Statements

Very few statements in the stories were recalled exactly as presented in the original story versions. Certain types of transformations occurred regularly in all protocols. These transformations included substitution of words, deletions, and additions of information within statements. The most common transformations were verb substitutions. These substitutions occurred in 60% of all statements recalled in the four stories. Children substituted verbs such as went for ran, broke for cracked, told for warned, etc. In almost all cases, verb substitution involved the replacement of the original verb with one that shared some meaning with the original but was semantically less complex.

Deletions and additions of information also occurred. The three types of information which were deleted most frequently were adverbs, adjectives, and prepositional phrases. For example, in The Fox and Bear, children heard the statement, "they decided to catch a chicken for supper." 91% of all children who recalled this statement deleted "for supper." Another example can be taken from The Fox and Bear. Children heard the statement, "the fox then opened the door of the henhouse very carefully." In over 50% of the protocols, children simply said, "the fox opened the door." They did not specify which door he opened or how he opened it. When "where," "how" or "when" information occurred in the stories, it was deleted from recall over 50% of the time. Adjectives like "new" and "beautiful" were also deleted consistently. However, additions did occur in the recalls and most involved new adjectives. For example, in The Tiger's Whisker, 32% of all subjects said that the tiger was not only lonely but that he was also old and poor.

One type of substitution occurred only in first grade recalls. Ten percent of the children had difficulty remembering exactly who was the main character in a story. The two stories that presented the most difficulty in this regard were The Fox and Bear and The Tiger's Whisker. In The Fox and Bear, some children

confused the actions of the fox and the bear or substituted another animal for the bear. In The Tiger's Whisker, the most common error was the substitution of a lion for the tiger. These character substitutions, however, did not detract from the production of a well organized story. In addition, these types of substitution errors were virtually absent from fifth grade protocols.

One major type of transformation occurred in all of the protocols at both grade levels. Over 50% of all internal responses recalled were produced in an active form by changing the internal response of a character to an action on the part of the character. A clear example of this phenomenon is taken from the story, Judy's Birthday. This story had many statements which described the goals and thoughts of both Judy's father and grandmother. If children recalled these statements, they did so by having the father and grandmother tell Judy about their thoughts or feelings. An example from one protocol is the following recall:

> When Judy told her grandmother about what she wanted, her grandmother said to her; "I understand. I'll get them for you because you'll need them when you get to be a woman."

Thus, not only did this subject integrate and delete information but he also externalized the grandmother's thoughts by providing a conversational exchange between the two characters.

Additions of New Categories

The number of category additions was then tabulated for each subject. In order to receive credit for including new category information, subjects had to add information which was not similar to the story content in any form. An example of entirely new information added is taken from two fifth grade protocols. When these two subjects recalled The Fox and Bear, both children added new information at the beginning and at the end of the story. Both subjects stated that the fox and the bear were very hungry and had to find something to eat. Then they continued on with the remainder of the story. As they approached the

end, both said that the farmer was very angry and was going to shoot the two animals. These two protocols each contained four new category additions.

An analysis of variance was completed on the total number of category additions with grade (1st and 5th) as the between subject variable and time (immediate and delayed) as the within subject variable. Each story was analyzed separately. The mean number of additions per story is presented in Table 7.

Insert Table 7 about here

In three of the four stories, 5th grade children included significantly more new category information in their recalls than 1st grade children. In one story, Judy's Birthday, there were no differences between the two grades. Time was a significant variable for only one story, Judy's Birthday. In this story, all subjects added significantly more new information to recall in the delayed condition than in the immediate time condition. There were no significant interactions between time and grade for any story.

The inferences almost always made sense within the story; they provided logical links between information that had been explicitly given. For example, in The Tiger's Whisker, the character's main goal stated in the story was "to make a medicine for her husband." Many subjects, especially 5th grade children, inserted the primary goal "to cure her husband" or "to make him feel better." In addition, the story never included information as to the lady's activities after she cut off the tiger's whisker. Almost all fifth grade children completed the lady's episode by stating, "she cut off the tiger's whisker, ran home, and made the medicine for her husband."

The same type of additions were found in The Fox and Bear. In the original version, there was no initiating event in the beginning of the first episode. In the protocols, 33% of the first grade children and 75% of the fifth grade

children included information which preceded the decision to kill a chicken for supper. Most children said, "the fox and the bear were really hungry." A few said, "they hadn't eaten for days and they needed something to eat."

The categories most frequently added to the story recalls were internal responses and attempts. Forty-one percent of all new categories were internal responses and 37% were attempts. The next largest category added was the consequence category which consisted of 18% of the new responses. The remainder of the new information was distributed among the setting, initiating event, and reaction categories.

The fact that internal responses were consistently added to recall protocols is extremely important because in assessing accurate recall the internal response category was among the least well recalled categories. This discrepancy between the two findings indicates that children are extremely aware of characters' feelings, thoughts, and goals. The child's comprehension of exactly what these internal feelings or motives are may be different from the internal responses given in the original story versions.

The type of new information added to stories was fairly consistent across grade level in three of the four stories. The only story which contained grade differences in the type of new information added in recall was Story 4, Judy's Birthday. First grade children added twice as many activity statements as fifth grade children did. However, fifth grade children added almost three times as many internal responses to their recall as did first grade children. The addition of internal responses explains some of the decrease in fifth grade recall during the delayed condition. Fifth graders did in fact recall significantly fewer accurate, internal responses on delayed recall. However, this type of category did not decrease in saliency when new information was assessed. The only thing that changed was the semantic content of the internal responses. In the original story, Judy asked her father to get them (tools) for her. The father's response

in the original version is given in the next four lines:

1. Her father did not want to get them for her.
2. He did not think that girls should play with a hammer and a saw,
3. but he wanted to get her something.
4. So, he bought her a beautiful new dress.

An example of a fifth grader's recall of the father's response was:

1. Judy's father couldn't get her the tools.
2. He didn't want her to get hurt,
3. because kids can get cut when they play with sharp things.
4. He knew she would be disappointed.
5. So he thought he'd get her something very special.
6. So he bought her a pretty dress.

Thus, children recalled as many internal responses as the original story version but added new information which they had inferred from the original story presentation.

The fact that younger children added more new attempt categories than older indicates that first grade children are extremely capable of adding new information. Younger children may have a more restricted range in terms of the amount and/or the types of new information which they can generate.

Temporal Sequencing Errors in Accurate Recall

The next measure completed on the story recalls concerned the degree to which children were able to recall the story information in the sequence presented in the original stories.

A rank order index was constructed in which the order of an individual subject's recall was compared to the order of the items in the original story structure. Three types of temporal reversals were classified as errors in this rank ordering: 1) intercategory reversals, 2) intracategory reversals, and 3) reversals occurring within a single statement. A Spearman rank order correlation

was computed for each individual subject, and then subject means were tabulated for each grade level and each time condition. An analysis of variance was not completed on this data because the number of items recalled by each subject was extremely variable. The mean correlations were used simply as an index of goodness concerning temporal sequencing of story information and are presented in Table 8.

Insert Table 8 about here

All of the correlation coefficients were above .92 with the exception of one which was .82. The relationship between the subjects' sequence of information and the original story presentations were extremely high in all cases. The three types of temporal sequencing errors were then analyzed separately.

An intercategory error was defined as the temporal reversal of two statements, each from a different category specified in the grammar. The percentage of intercategory error for all four stories was minimal. Only 7% of all statements recalled in the four stories contained intercategory reversals. In addition, 75% of all reversals could be predicted from the proposed tree structures of each story diagramed in Figure 2. Three of the four original story versions contained statements that were reversed when compared to their position in the tree structure. An example of temporal disorganization occurring in the presented version of a story can be seen in The Tiger's Whisker. The initiating event, which should occur immediately after the major setting statement, does not occur until the character's major goals are presented. The tree structure which represents the hypothesized internal structure of the subject in recalling the story reverses the order of the intiating event. Almost all intercategory errors in this story occurred when subjects recalled the initiating event before any of the internal response statements. A similar finding occurred in The Fox and Bear. In the original story, the minor setting statement, "they both liked

fried chicken," occurred between a goal and an action statement. Several children reversed the position of the minor setting statement in story recall and stated the information immediately after the major setting statement.

The remainder of intercategory errors occurred when two characters were interacting with one another. In Epaminondas, the major intercategory reversal occurred when children inserted the first action statement between the first two initiating events. An example of this reversal was: "the mother told him to take some cake to his grandmother. He put the cake in a leaf under his arm. Then she warned him to hold it carefully." The same type of reversal occurred in the fourth story, Judy's Birthday. Several children stated the direct consequence, "she gave them to Judy that night," and then stated, "she (grandmother) told Judy she would need them when she grew up." Thus, they reversed the order of the consequence statement and one statement from the internal response category.

The number of intracategory errors occurring in recalls was also measured. An intracategory error was defined as the reversal of two statements within the same category. The two stories which produced the most intracategory errors were Epaminondas and The Tiger's Whisker. Only 5% of all the information recalled included intracategory errors. Two types of intracategory errors occurred. Children either reversed entire statements within a category or they deleted part of a statement and put the remainder after the second statement in the category. The second type of intracategory error occurred most frequently in Epaminondas. Children reversed the first two attempt statements by stating that the boy carried the cake in a leaf under his arm. This type of error is similar to a truncation error in which subjects delete information in order to make their productions less redundant.

The third type of temporal sequencing error, within statement reversals,

occurred in 11% of the protocols. This error occurred primarily when children inverted the order of temporal markers included in a statement. One statement which contained consistent reversals was: she (grandmother) went out that day... Subject often stated: that day she went out. With the exception of these types of reversals, subjects maintained the correct position of the information within statements.

Discussion

This study had two major goals. The first was to examine the effect of age and time on the production of stories. Significant developmental differences did occur when accurate recall was measured. Fifth grade children always recalled more informational categories than first grade children on immediate recall. The superiority of fifth grade recall was maintained on delayed recall for three of the four stories. The effect of time was significant for three of the four stories. All children recalled more during immediate recall than on delayed recall. When the story recalls were broken down and categorized according to the seven primary categories occuring in an episode, developmental differences were consistently found in the internal response category. Fifth grade children recalled significantly more internal response statements than first grade children in all four stories.

The pattern of information recalled by children in both grades was not random. Furthermore, the pattern of item salience was highly consistent over grade and time conditions. This finding indicates that, although there are significant differences in recall due to age and time conditions, the organization of the recall in terms of saliency of informational units is extremely stable.

Children's productions of the story sequence closely resembled the sequence of the original story material. There were very few temporal ordering errors.

Reversals of words within a single statement occurred more frequently than any other type of temporal errors. Intra-category and inter-category reversals occurred rarely. Most inter-category errors occurred when there was a discrepancy between the logical sequence in the original stimulus version of the story and the proposed internal representation of the story. In addition, children reversed inter-category statements in an attempt to make the interaction between two characters more action-oriented. Intra-category errors were the least common temporal sequencing errors. When these errors did occur, children deleted part of an initial statement and placed the remainder of the statement after the second occuring statement.

Almost all of the recalls included some type of added or inferred category information. Significant developmental differences occurred in the production of new information in three of the four stories. Fifth graders added more new categories than first graders. In the fourth story there were no significant overall developmental differences. However, when the total number of inferences were analyzed according to category type, it was found that fifth graders added significantly more new internal responses than did first graders. In contrast to this, first graders added more new attempt responses. This finding suggests that younger children are indeed capable of producing inferences. However, the type of story information which promotes inferential reasoning may be different depending upon the age of the subject.

All of these findings support the thesis that story recall is highly organized in children. The data are also consistent with the types of results found in adult recall (Bartlett, 1932; Johnson, 1970) and replicate the results from our previous experiment (Stein and Glenn, 1975). Furthermore, the addition of new category items support Bartlett's thesis that recall, in part, is based upon constructive mechanisms; that is, a story recall is an interaction between

the incoming information and the types of strategies and structures available to the subject. The presence of verb and adjective substitutions, the deletion of prepositional phrases, location information, andcertain types of category information, and the temporal reversals occuring within single statements indicates that the internal representation of story material is based, for the most part, on semantic relations occuring within the stories. Recall was found to be quite independent from the syntactic structure of the original story versions.

The second purpose of this study was to examine the usefulness of making distinctions between different types of information occuring in stories. It was found that not all category types of information were equally well recalled. The types of category information most frequently recalled were highly consistent across stories, grade level and within time conditions. Major settings, direct consequences, and initiating events were the most frequently recalled categories. The remaining categories, in terms of the frequency of occurrence in recall, were: attempt, reaction, minor setting, and internal response. Although the internal response was the most frequently deleted category, the primary goal statement of the major character was not. This implies that some types of internal response statements are extremely important in the production of a story.

The fact that category membership was predictive of item saliency in story production supports the thesis that certain types of information are more important than others in producing stories. It also suggests that story recall is somewhat independent of simple primacy and recency effects. This assertion is supported by the fact that minor setting statements occuring at the beginning of the story and reaction statements occuring at the end are not well recalled. In addition, initiating events and consequence statements were well recalled independent of their location in the stories.

Although category membership was important in determining the salience of an item in recall, it alone does not totally predict an item's salience. When the distribution of each category's salience was analyzed, it was found that some items in each category were highly salient and other items in the same category were poorly recalled. For example, attempt statements were scattered throughout the recall frequencies. This indicates that variables other than category membership may influence item salience. One type of variable may be the specific semantic information of an item. It may be that as a subject hears an informational item, he makes hypotheses about the next one; that is, he may infer the information which is most likely to follow. If the following item does correspond to his expectations, he may be more likely to remember that item; if he does not, he may not remember the item and in fact he may substitute his hypothesized item. For example, in the Fox and the Bear, the attempt category included the following statements: "the fox then opened the door of the henhouse very carefully. He grabbed a chicken and killed it." Grabbing a chicken was not highly recalled; however, subjects often said he went into the henhouse.

A second variable which may regulate item salience in story recall is the redundancy occuring in a particular statement. If the information in a statement can be inferred from or assumed by information stated in a second item in the external story, there may be no reason for a subject to include the information in a statement which appears redundant to a subject. Not all items are necessary for the subject to produce a coherent story.

The type of relations occuring between each statement within a category may also be critical in predicting how many statements from each category are produced in recall. Subjects may recall only the sequence of items that have a direct causal relation linking them. This hypothesis may be particularly valid when several statements occur within one category.

In summary, the findings from this study support previous research in adult prose organization. They also provide evidence for the usefulness of the story schema, both as a methodological tool for parsing stories into informational units and as a theoretical structure for defining the internal representation of story information.

Two major aspects of the schema which have not been examined in this study are: (1) the validity of the distinctions made between types of relations connecting inter-category and intra-category items, and (2) the distinction between the ability to produce story information and the ability to encode critical information occuring in stories.

These two aspects are pursued in our additional studies.

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Table 1

Mean Proportion of Total Accurate Recall

	Grade Comparisons		
Story	Grade 1	Grade 5	F Ratio and Significance Level
Epaminondas	.47	.65	F(1,22) = 13.76, p .001
Tiger's Whisker	.48	.58	F(1,22) = 4.34, p .03
Fox and Bear	.42	.51	F(1,22) = 6.02, p .01
Judy's Birthday	.47	.54	- ns -

	Time Comparisons		
Story	Time 1	Time 2	F Ratio and Significance Level
Epaminondas	.57	.51	- ns -
Tiger's Whisker	.55	.50	F(1,22) = 6.77, p .01
Fox and Bear	.51	.42	F(1,22) = 21.35, p .0003
Judy's Birthday	.56	.45	F(1,22) = 27.16, p .0001

Grade X Time Interaction

Judy's Birthday	Grade 1 (T1)	Grade 1 (T2)	Grade 5 (T1)	Grade 5 (T2)
Mean Proportion of Total Accurate	.50	.44	.62	.48
F Ratio and Significance Level for Grade X Time Interaction	F(1,22) = 5.63, p .02			

Table 2

Mean Proportion of Internal Response Statements

with Significance Levels Comparing Grade Differences

Story	Grades 1	Grades 5	Significance Level
Epaminondas	.08	.35	$F(1,22) = 5.07$, $p < .05$
Tiger's Whisker	.28	.45	$F(1,22) = 10.09$, $p < .01$
Fox and Bear	.28	.44	$F(1,22) = 5.09$, $p < .05$
Judy's Birthday	.42	.54	$F(1,22) = 4.14$, $p < .05$

Table 3

Mean Proportion of Internal Response Statements

with Significance Levels Comparing Time Conditions

Story	Time 1	Time 2	Significance Level
Epanimondas	.28	.16	- ns -
Tiger's Whisker	.41	.33	$F(1,22) = 4.11$, $p < .05$
Fox and Bear	.40	.32	$F(1,22) = 5.09$, $p < .05$
Judy's Birthday	.55	.41	$F(1,22) = 4.85$, $p < .05$

Table 4

Correlations Between Grades and Within Time Conditions in the Degree of Relationship Between the Rank Order of Best to Least Recalled Statements in Each Story

Story	Grade 1 X Grade 5	Time 1 X Time 2
1. Epaminondas	.84	.91
2. Tiger's Whisker	.84	.94
3. Fox and Bear	.98	.97
4. Judy's Birthday	.98	.99

Table 5

Rank Order of Categories for Four Stories.

Ranks are Integrated Over Grade and Time Conditions

With Best Remembered Items Having the Lowest Ranks

and Worst Remembered Items Having the Highest Ranks

	Story 1	Story 2	Story 3	Story 4
Category	Epaminondas	Tiger's Whisker	Fox and Bear	Judy's Birthday
Major Setting	1	1	1	1
Direct Consequence	2	3	2	2
Initiating Event	3	2	3	3
Attempt	4	5	4	4
Reaction	5	4	-	7
Minor Setting	6	7	6	5
Internal Response	7	6	5	6

Table 6

Distribution of Category Variation for Four Stories.

The Proportion of Each Category Recalled in the Top Third,

Middle Third or Bottom Third of the Distribution

Category	Top Third	Middle Third	Bottom Third	Number of Statements in Each Category
Major Setting	1.00	0	0	3
Minor Setting	0	.71	.29	7
Initiating Event	.63	.13	.25	8
Internal Response	.10	.31	.59	39
Attempt	.53	.16	.32	19
Direct Consequence	.87	.13	0	15
Reaction	.22	.56	.22	9

Table 7

Mean Number of New Categories Added to Each Story

by Grade Level and Time Condition

Story	Grade 1		Grade 5	Time 1		Time 2
1. Epaminondas	1.04	**	2.75	1.75		1.91
2. Tiger's Whisker	1.02	***	2.87	1.95		2.12
3. Fox and Bear	1.83	***	3.79	2.45		3.16
4. Judy's Birthday	2.80		1.98	1.95	*	2.58

*$p < .05$

**$p < .01$

***$p < .001$

Table 8

Correlations for the Degree of Relationship Between the Temporal Sequence of Statement in the Original Story Structure and the Temporal Sequence Recalled by Children

	Time 1		Time 2	
Story	Grade 1	Grade 5	Grade 1	Grade 5
Epaminondas	.97	.99	.95	.99
Tiger's Whisker	.81	.99	.93	.99
Fox and Bear	.97	.95	.93	.96
Judy's Birthday	.92	.97	.97	.97

Figure 1

Summary of Grammatical Rules

1. Story ⟶ ALLOW (Setting, Episode System)
2. Setting ⟶ (State, Action)
3. Episode System ⟶ AND / THEN / CAUSE [Episodes, Episodes]
4. Episode ⟶ INITIATE (Initiating Event, Response)
5. Initiating Event ⟶ (Natural Occurence, Action, Internal Event)
6. Response ⟶ MOTIVATE (Internal Response, Plan Sequence)
7. Internal Response ⟶ (Goal, Affect, Cognition)
8. Plan Sequence ⟶ INITIATE (Internal Plan, Plan Application)
9. Internal Plan ⟶ (Cognition, Subgoal)
10. Plan Application ⟶ RESULT (Attempt, Resolution)
11. Attempt ⟶ (Action)
12. Resolution ⟶ INITIATE (Direct Consequence, Reaction)
13. Direct Consequence ⟶ (Event, End State)
14. Reaction ⟶ (Affect, Cognition, Action)

Intra-category connectors:

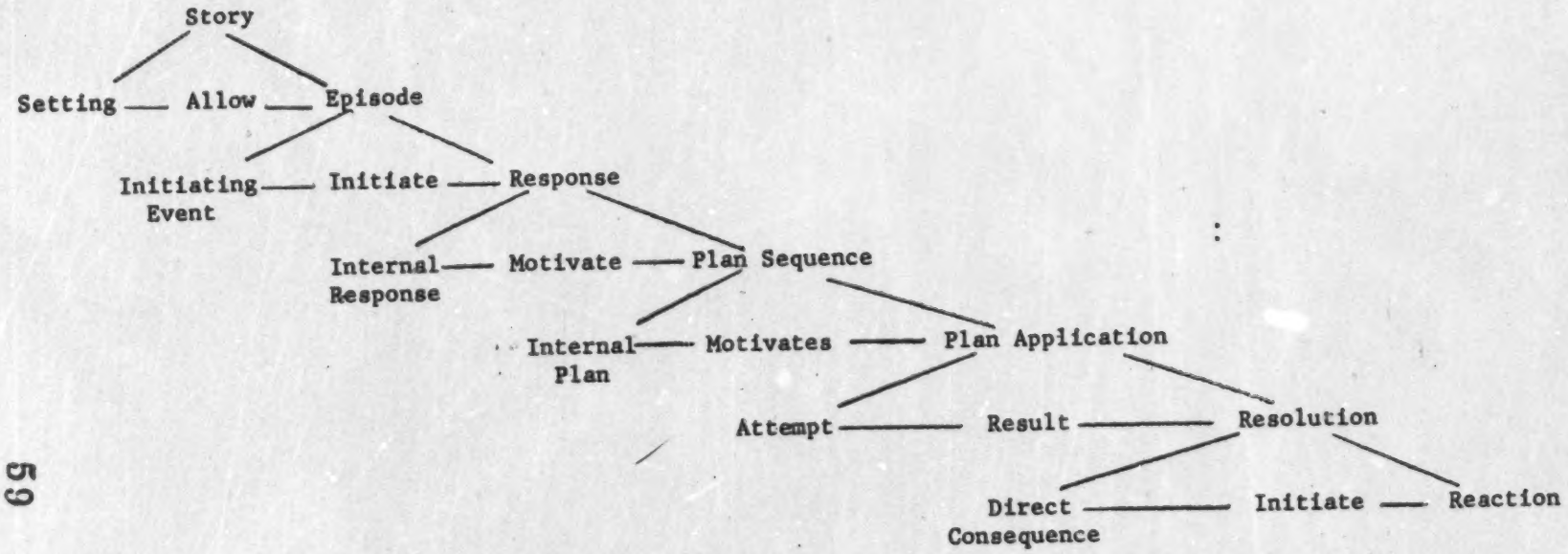
AND: includes simultaneous or a temporal relation.

THEN: includes temporal but not direct causal relations.

CAUSE: includes temporal relations which are causal in nature.

Figure 2

Structure of a Simple Episode



Story 1: Epaminondas

Category Type	Type of Information	Statement
Major Setting	State	1. Once there was a little boy
Minor Setting	State	2. who lived in a hot country
Initiating Event	Action	3. One day his mother told him to take some cake to his grandmother
Initiating Event	Action	4. She warned him to hold it carefully
Initiating Event	Action	5. so it wouldn't break into crumbs
Attempt	Action	6. The little boy put the cake in a leaf under his arm
Attempt	Action	7. and carried it to his grandmother's
Direct Consequence	End State	8. When he got there
Direct Consequence	End State	9. the cake had crumbled into tiny pieces.
Reaction	Action	10. His grandmother told him he was a silly boy
Reaction	Action	11. and that he should have carried the cake on top of his head
Reaction	Action	12. so it wouldn't break
Initiating Event	Action	13. Then she gave him a pat of butter to take back to his mother's house
Internal Response	Goal	14. The little boy wanted to be very careful with the butter
Attempt	Action	15. so he put it on top of his head
Attempt	Action	16. and carried it home
Minor Setting	State	17. The sun was shining hard
Direct Consequence	End State	18. and when he got home
Direct Consequence	End State	19. the butter had all melted
Reaction	Action	20. His mother told him that he was a silly boy
Reaction	Action	21. and that he should have put the butter in a leaf
Reaction	Action	22. so that it would have gotten home safe and sound

Story 2: The Tiger's Whisker

Category Type	Type of Information	Statement
Major Setting	State	1. Once there was a woman
Internal Response	Goal	2. who needed a tiger's whisker
Internal Response	Affect	3. She was afraid of tigers
Internal Response	Goal	4. but she needed a whisker
Internal Response	Goal	5. to make a medicine for her husband
Initiating Event	Natural Occurrence	6. who had gotten very sick
Internal Response	Cognition	7. She thought and thought
Internal Response	Goal	8. about how to get a tiger's whisker
Internal Plan	Goal	9. She decided to use a trick
Internal Plan	Cognition	10. She knew that tigers loved food and music
Internal Plan	Cognition	11. She thought that if she brought food to a lonely tiger
Internal Plan	Cognition	12. and played soft music
Internal Plan	Cognition	13. the tiger would be nice to her
Internal Plan	Cognition	14. and she could get the whisker
Attempt	Action	15. So she did just that
Attempt	Action	16. She went to a tiger's cave
Minor Setting	State	17. where a lonely tiger lived
Attempt	Action	18. She put a bowl of food in front of the opening to the cave
Attempt	Action	19. Then she sang soft music
Attempt	Action	20. The tiger came out
Direct Consequence	End State	21. and ate the food
Attempt	Action	22. He then walked over to the lady
Direct Consequence	End State	23. and thanked her for the delicious food and lovely music
Direct Consequence	End State	24. The lady then cut off one of his whiskers
Direct Consequence	End State	25. and ran down the hill very quickly
Reaction	Affect	26. The tiger felt lonely and sad again

Story 3: Fox and Bear

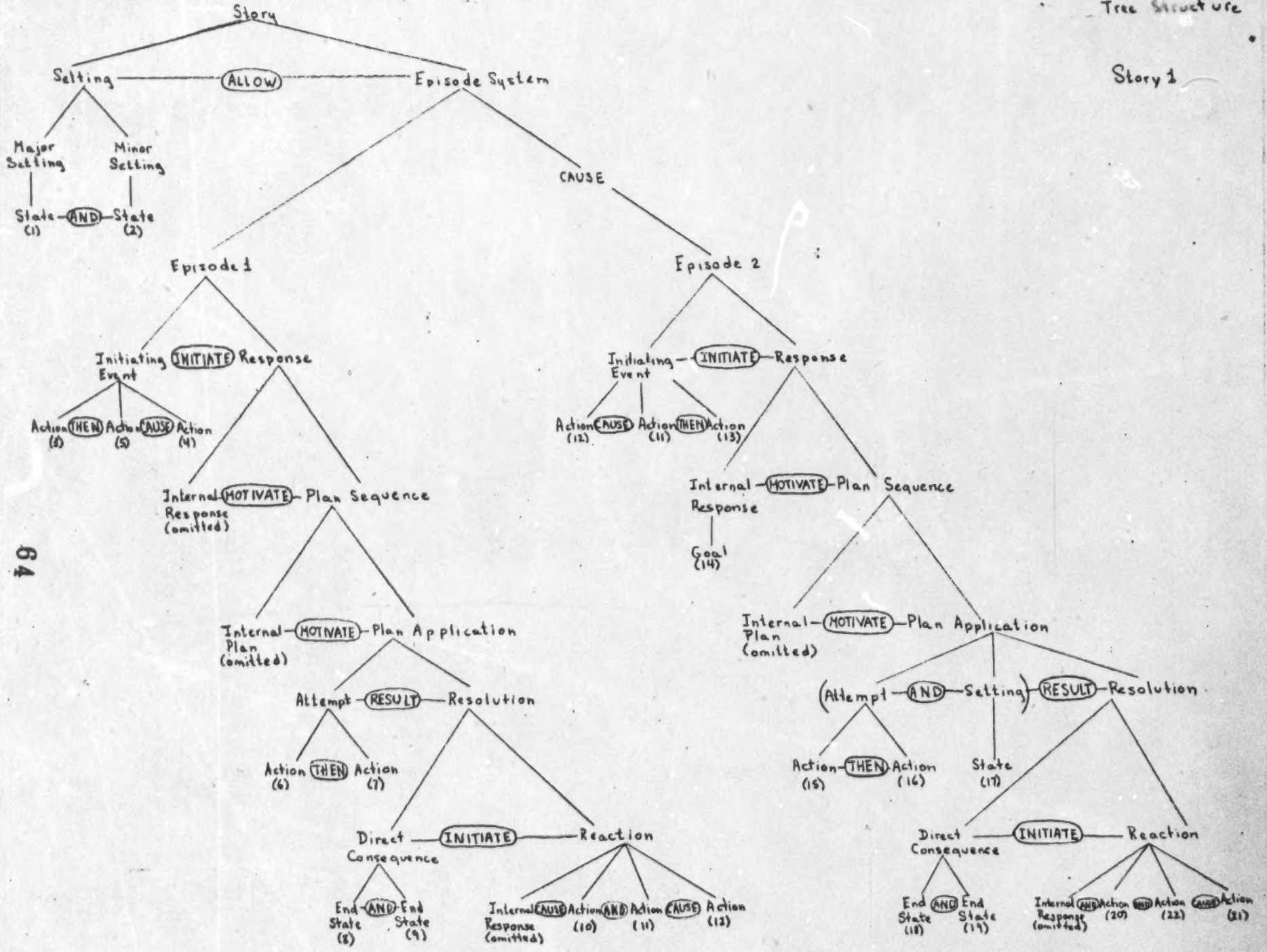
Category Type	Type of Information	Statement
Major Setting	State	1. There was a fox and a bear
Minor Setting	State	2. who were friends
Internal Response	Goal	3. One day they decided to catch a chicken for supper
Internal Response	Goal	4. They decided to go together
Internal Response	Goal	5. because neither one wanted to be left alone
Minor Setting	State	6. and they both liked fried chicken
Attempt	Action	7. They waited until night time
Attempt	Action	8. Then they ran very quickly to a nearby farm
Internal Response	Cognition	9. where they knew chickens lived
Internal Response	Affect	10. The bear, who felt very lazy
Attempt	Action	11. climbed upon the roof
Internal Response	Goal	12. to watch
Attempt	Action	13. The fox then opened the door of the henhouse very carefully
Attempt	Action	14. He grabbed a chicken
Direct Consequence	End State	15. and killed it
Initiating Event	Action	16. As he was carrying it out of the henhouse
Initiating Event	Natural Occurrence	17. the weight of the bear on the roof caused the roof to crack
Initiating Event	Internal Event	18. The fox heard the noise
Internal Response	Affect	19. and was frightened
Minor Setting	State	20. but it was too late
Internal Response	Goal	21. to run out
Direct Consequence	Event	22. The roof and the bear fell in
Direct Consequence	Event	23. killing five of the chickens
Direct Consequence	End State	24. The fox and the bear were trapped in the broken henhouse
Attempt	Action	25. Soon the farmer came out
Internal Response	Goal	26. to see what was the matter

Story 4: Judy's Birthday

Category Type	Type of Information	Statement
Initiating Event	Natural Occurrence	1. Judy is going to have a birthday party
Major Setting	State	2. She is ten years old
Internal Response	Goal	3. She wants a hammer and a saw for presents
Internal Response	Goal	4. Then she could make a coat rack
Internal Response	Goal	5. and fix her doll house
Attempt	Action	6. She asked her father
Internal Response	Goal	7. to get them for her
Internal Response	Goal	8. Her father did not want to get them for her
Internal Response	Cognition	9. He did not think that girls should play with a hammer and a saw
Internal Response	Goal	10. But he wanted to get her something
Direct Consequence	End State	11. So he bought her a beautiful new dress
Internal Response	Affect	12. Judy liked the dress
Internal Response	Goal	13. but she still wanted the hammer and the saw
Attempt	Action	14. Later she told her grandmother about her wish
Internal Response	Cognition	15. Her grandmother knew that Judy really wanted a hammer and a saw
Internal Response	Goal	16. She decided to get them for her
Internal Response	Cognition	17. because when Judy grows up
Internal Response	Cognition	18. and becomes a woman
Internal Response	Cognition	19. she will have to fix things
Internal Response	Cognition	20. when they break
Attempt	Action	21. Then her grandmother went out that very day
Direct Consequence	End State	22. and bought the tools for Judy
Direct Consequence	End State	23. She gave them to Judy that night
Reaction	Affect	24. Judy was very happy
Reaction	Cognition	25. Now she could build things with her hammer and saw

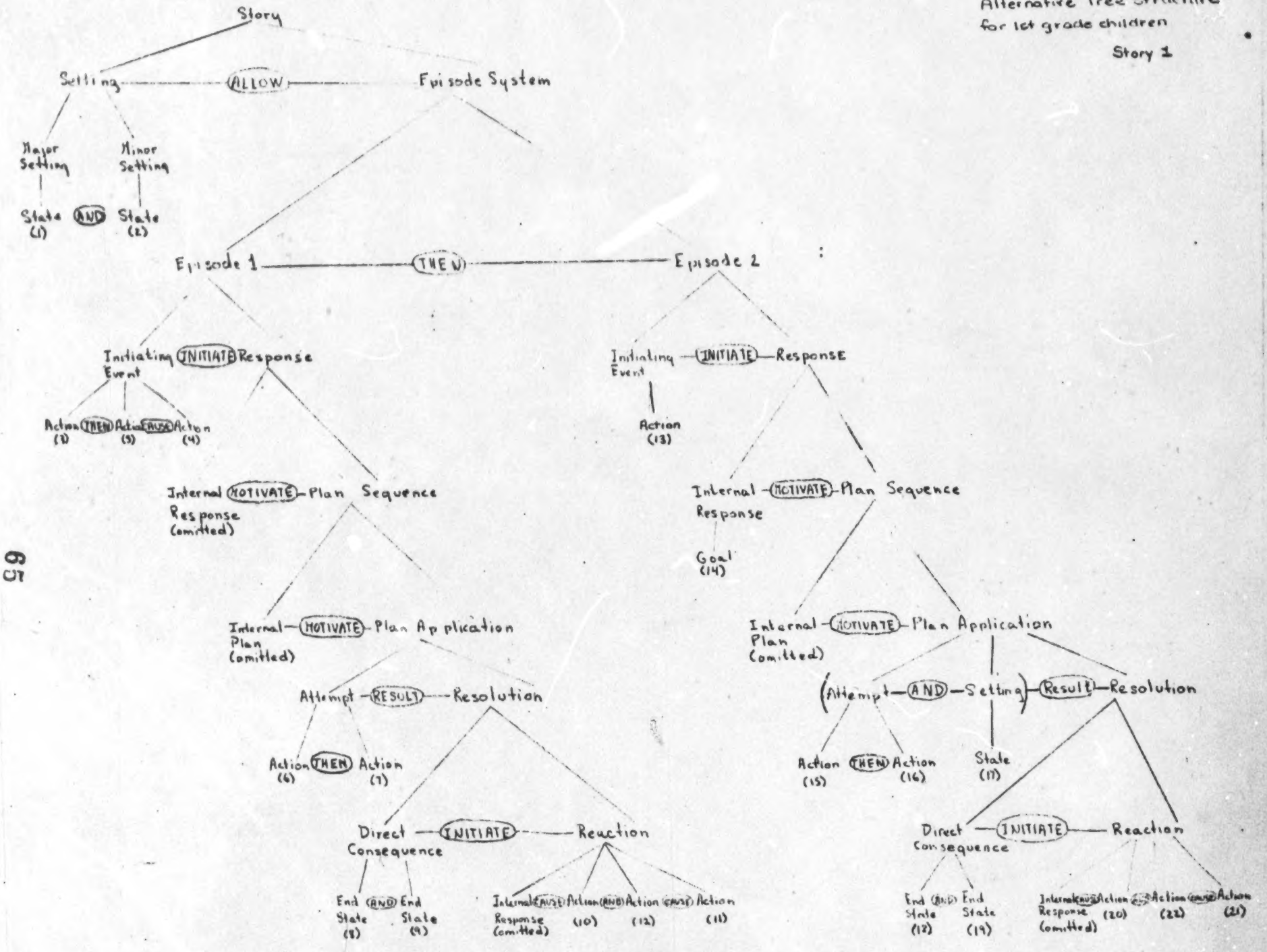
Epanimondas
Tree Structure

Story 1



Epanimondas
Alternative Tree Structure
for 1st grade children

Story 1



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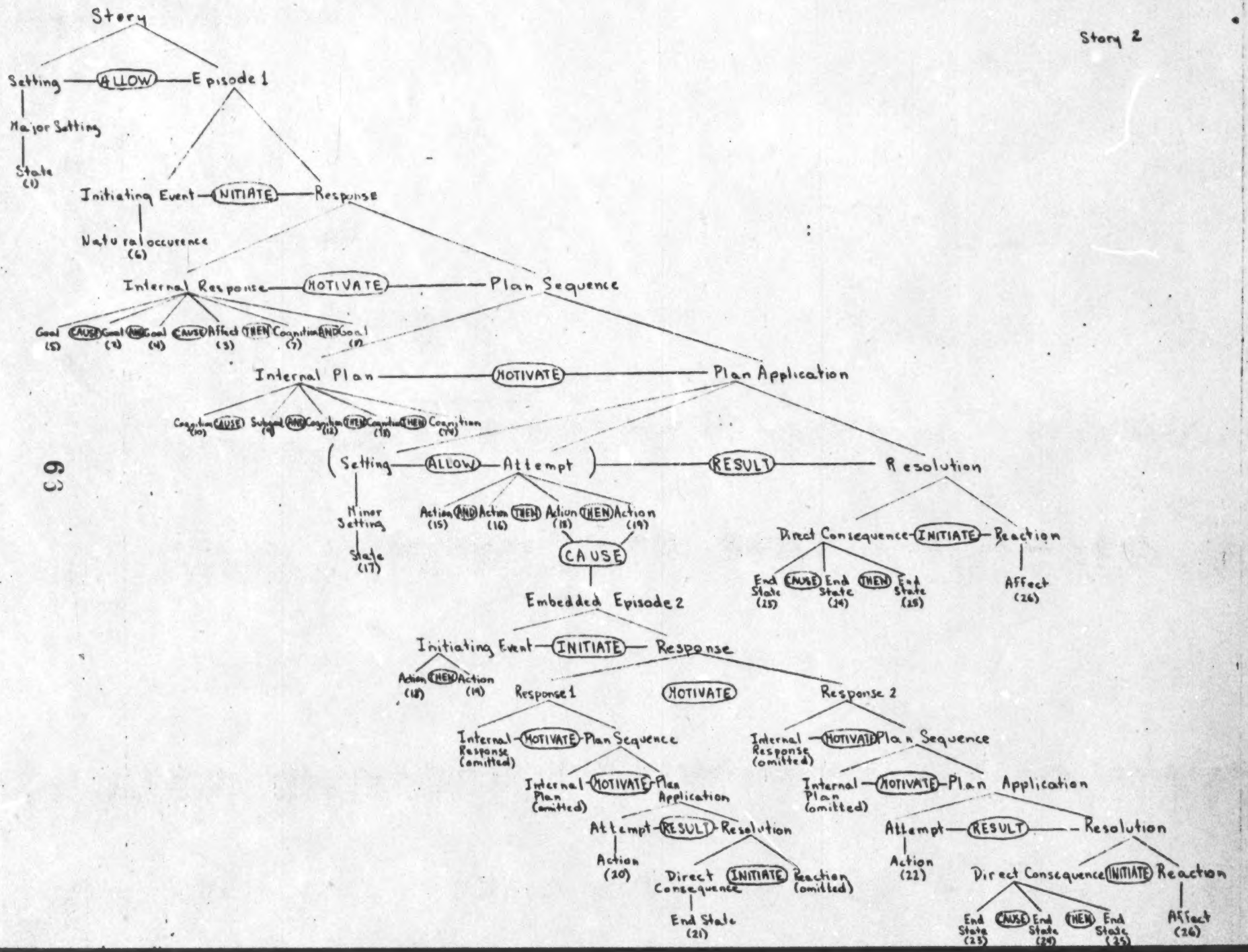
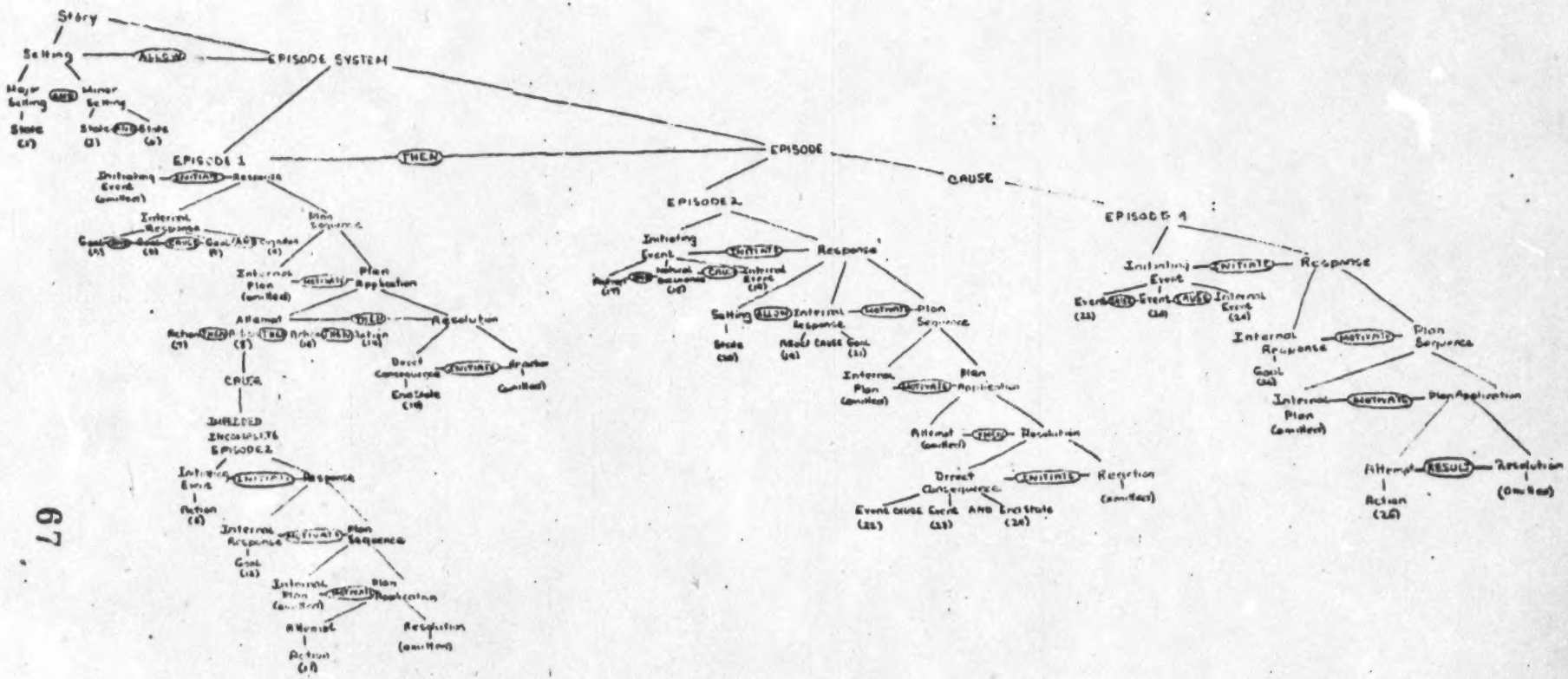
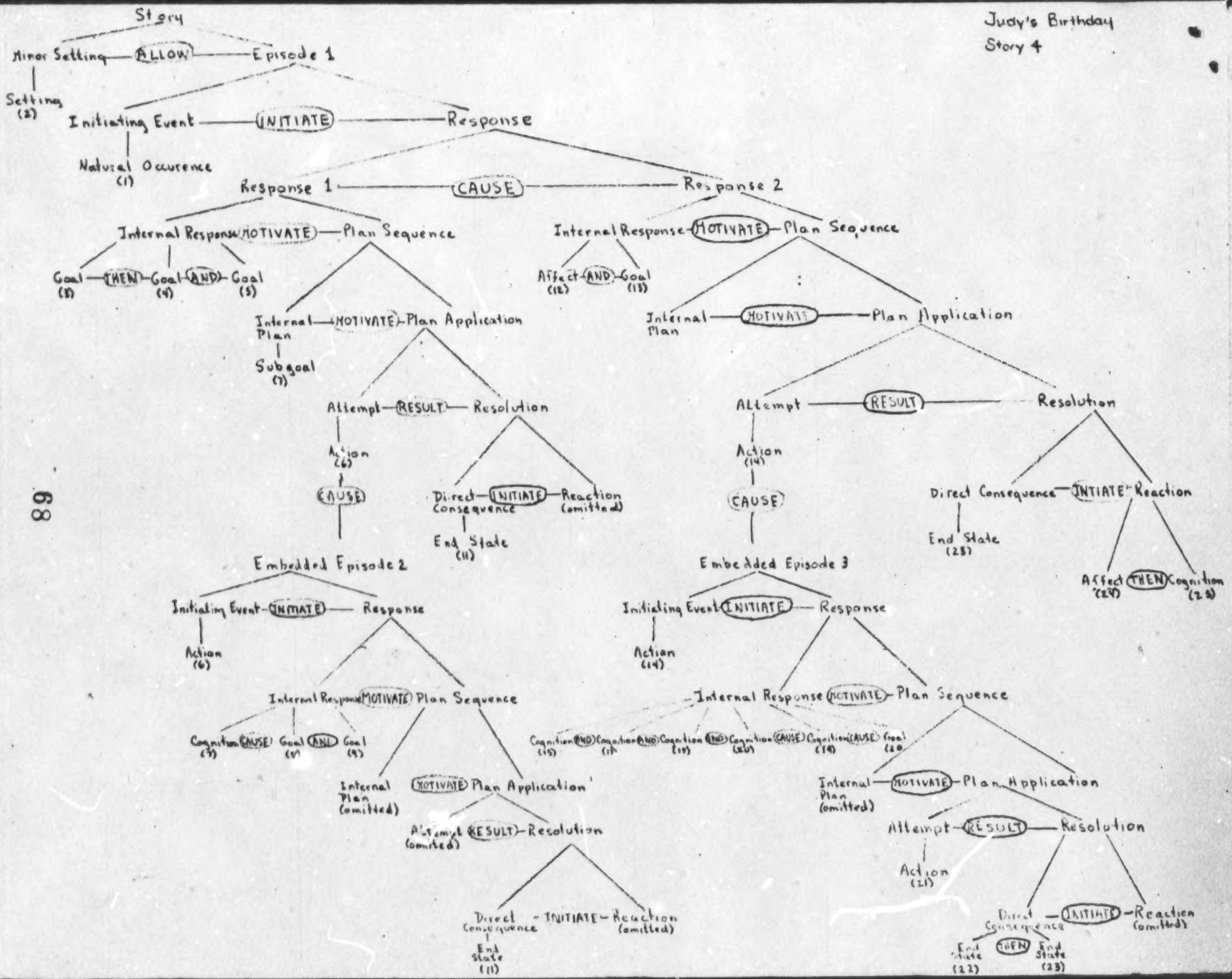
Tiger's Whisker

Tree Structure

Story 2




Story
Setting
ALSO
EPISODE SYSTEM
Major Setting
AND
Minor Setting
State (1)
State (3)
AND
State (4)
EPISODE 1
THEN
EPISODE
CAUSE
Initiating Event (omitted)
INITIATES
Response
Internal Response
Plan Sequence
Goal (A)
Goal (B)
CAUSE
Goal (C)
Expands (4)
Goal (D)
Internal Plan (omitted)
MOTIVATES
Plan Application
Attempt
ENABLES
Resolution
Action (7)
Action (8)
Action (9)
Action (10)
Direct Consequence
End State (14)
Action (omitted)
CAUSE
IMPLIED INCOMPLETE EPISODE 2
Initiating Event
Action (6)
Response
Internal Response
Goal (12)
Plan Sequence
Internal Plan (omitted)
Plan Application
Attempt
Action (13)
Resolution (omitted)
EPISODE 2
Initiating Event
Response
Setting
ALSO
Internal Response
Plan Sequence
State (20)
Goal (21)
Internal Plan (omitted)
Plan Application
Attempt (omitted)
Resolution
Direct Consequences
Reaction (omitted)
Event (23)
AND
End State (24)
EPISODE 4
Initiating Event
Response
Event (22)
AND
Event (19)
CAUSED
Internal Event (18)
Internal Response
Plan Sequence
Goal (26)
Internal Plan (omitted)
Plan Application
Attempt
RESULT
Resolution (omitted)
Action (25)


Judy's Birthday
Story 4
Story
Minor Setting
ALLOW
Episode 1
Setting (2)
Initiating Event
INITIATE
Response
Natural Occurence (1)
Response 1
CAUSE
Response 2
Internal Response
MOTIVATE
Plan Sequence
Goal (3)
THEN
Goal (4)
AND
Goal (5)
Internal Plan
Plan Application
Subgoal (7)
Attempt
RESULT
Resolution
Action (6)
Direct Consequence
Reaction (omitted)
End State (11)
Affect (12)
Goal (13)
Action (14)
End State (25)
Affect (24)
THEN
Cognition (25)
Embedded Episode 2
Cognition (8)
Internal Plan (omitted)
Attempt (omitted)
Embedded Episode 3
Cognition (15)
Cognition (16)
Cognition (17)
Cognition (18)
Cognition (19)
Goal (20)
Action (21)
End State (22)
End State (23)
89